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| **AUTHOR(S)** | DATE | Document Change Notice, Release or Approval |
| Dennis Coyne, Calum Torrie, Hugh Radkins, Betsy Bland, | 19 Jan 2012 | see LIGO DCC record Status |

*Instructions on the use of this document:*

*1) Use, and complete, this document on a cleanroom compatible computer while the work is proceeding. This procedure, and all of the applicable documents, must be available at all times during the procedure.*

*2) Use this procedure as a check list for preparation and during the installation; As each step is completed, enter the name of the person completing the work (or approving or checking the step), as well as the date and any comments or notes. In particular, note any discrepancies or deviations and augment with any missing definition. ALL NOTES MUST BE RECORDED IN THE COMPLETED VERSION OF THIS DOCUMENT (NOT IN OTHER NOTEBOOKS OR FILES). If the additional notes are too cumbersome to include within the body of this completed procedure, then electronically attach them to the completed procedure.*

*3) Once completed, file the document in the LIGO Document Control Center (DCC) as the next highest version of the procedure and add a note that this is a completed/finished procedure.*

*4) File any significant notes or data from the completed procedure in the electronic logbook (such as any deviations); as a minimum note in the electronic logbook that the installation was completed in accordance with this procedure (cite document number and revision).*

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# SCOPE

The scope of this procedure is installation of interferometer components and assemblies in the LHAM2 and LHAM3 chambers (see ), which are defined in the following documents:

LHAM2:

* LIGO-D0900365: [AdvLIGO Systems, HAM2-L1 Top Level Chamber Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1070)
* LIGO-E1100820: [HAM2-L Top Level Chamber Assembly BOM](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=69997)
* LIGO-E1100742: [AdvLIGO Detailed Mass Properties-CG Report HAM Tables (LLO)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=68365)
* LIGO-D0900366: [AdvLIGO VE HAM2-L1 Vacuum Equipment Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1079)
* LIGO-D0900367: [AdvLIGO SEI HAM2-L1, XYZ Local CS for ISO Table](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1080)
* LIGO-D0900368: [AdvLIGO SUS HAM2-L1, XYZ Local CS for HLTS (PR3)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1081)
* LIGO-D0900369: [AdvLIGO SUS HAM2-L1, XYZ Local CS for HSTS (MC1,MC3,PRM)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1082)
* LIGO-D0900370: [AdvLIGO IO HAM2-L1, XYZ Local CS for SOS Assy (SM1,SM2,PMMT1,PMMT2)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1083)
* LIGO-D1101537: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS (SM1) Sub-Assy](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=68187)
* LIGO-D1101538: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS (SM2) Sub-Assy](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=68188)
* LIGO-D1101539: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS (PMMT1) Sub-Assy](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=68189)
* LIGO-D1101540: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS (PMMT2) Sub-Assy](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=68190)
* LIGO-D0900371: [AdvLIGO IO HAM2-L1 XYZ Local CS for Faraday Isolator](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1084)
* LIGO-D0900420: [AdvLIGO IO HAM2-L1, XYZ Local CS for In Vacuum Periscope](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1187)
* LIGO-D1101406: [AdvLIGO SUS HAM2-L1, XYZ Local CS for Fixed Mount Optics](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67378)
* LIGO-D1000581: [CABLE HARNESS ROUTING CONFIGURATION - HAM2](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=10116)
* LIGO-D1001625: [AdvLIGO HAM2-L1 ISI Table, Payload & Suspended Mass Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=12893)
* LIGO-D1101407: [AdvLIGO IO HAM2-L1, XYZ Local CS for MC Refl Preiscope](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67379)
* LIGO-D1101408: [AdvLIGO, SUS HAM2-L1 Table, IO Straight Baffle Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67380)
* LIGO-D1101409: [AdvLIGO IO HAM2-L1, XYZ Local CS for Refl Beam Dump Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67381)
* LIGO-D1101410: [AdvLIGO IO HAM2-L1, XYZ Local CS for IO PSL PD Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67382)
* LIGO-D1101411: [AdvLIGO SEI HAM2-L1, XYZ Local for OptLev DLC Components](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67384)
* LIGO-D1101412: [AdvLIGO IO HAM2-L1 Table, IO EQ Stop Baffle Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67385)
* LIGO-D1101296: [ALIGO, AOS, HAM Chamber, Optical Table, Hole Tabulation](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67117)
* LIGO-D1002885: [Flange Layout - L1 Horizontal Access Module 2 (HAM 2)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=22883)
* LIGO-D1101233: [ALIGO IO L1 HAM2 INSTALLATION PLATE LAYOUT](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=66708)
* LIGO-F1100030: [aLIGO Systems HAM2/3 Related Documents](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67119)
* LIGO-D1101775: [ALIGO, ELECTRICAL FEEDTHROUGH TYPES, TYPICAL SUBFLANGES, AND PORT CONFIGURATIONS](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=70179)

LHAM3:

* LIGO-D0900520: [AdvLIGO Systems, HAM3-L1 Top Level Chamber Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1491)
* LIGO-E1100818: [HAM3-L Top Level Chamber Assembly BOM](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=69967)
* LIGO-E1100742: [AdvLIGO Detailed Mass Properties-CG Report HAM Tables (LLO)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=68365)
* LIGO-D0900521: [AdvLIGO VE HAM3-L1, Vacuum Equipment Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1492)
* LIGO-D0900523: [AdvLIGO SUS HAM3-L1, XYZ Local CS for HSTS (PR2, MC2)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1494)
* LIGO-D0900522: [AdvLIGO SEI HAM3-L1, XYZ Local CS for ISO Table](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1493)
* LIGO-D0900524: [AdvLIGO SUS HAM3-L1, XYZ Local CS for HSTS (PR2) Sub-Assy](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1495)
* LIGO-D0900526: [AdvLIGO SUS HAM3-L1, XYZ Local CS for HSTS (MC2) Sub-Assy](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1497)
* LIGO-D1101393: [AdvLIGO SUS HAM3-L1, XYZ Local CS for MC2 and PR2 Scraper Baffles](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67335)
* LIGO-D1101118: [AdvLIGO HAM3-L1 ISI Table, Balance Masses Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=62705)
* LIGO-D1002235: [AdvLIGO SEI HAM3-L1, XYZ Local CS for IO Optic Mount Components](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=14681)
* LIGO-D1002234: [AdvLIGO SEI HAM3-L1, XYZ Local CS for ISC Components](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=14680)
* LIGO-D1101463: [CABLE HARNESS ROUTING CONFIGURATION, HAM 3](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67608)
* LIGO-D1101394: [AdvLIGO SEI HAM3-L1, XYZ Local CS for OptLev DLC Components](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67336)
* LIGO-D1101296: [ALIGO, AOS, HAM Chamber, Optical Table, Hole Tabulation](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67117)
* LIGO-D1002886: [Flange Layout - L1 Horizontal Access Module 3 (HAM 3)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=22885)
* LIGO-D1101249: [ALIGO IO L1 HAM3 INSTALLATION PLATE LAYOUT](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=66790)
* LIGO-F1100030: [aLIGO Systems HAM2/3 Related Documents](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67119)
* LIGO-D1101775: [ALIGO, ELECTRICAL FEEDTHROUGH TYPES, TYPICAL SUBFLANGES, AND PORT CONFIGURATIONS](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=70179)
* LIGO-D1101296: [ALIGO, AOS, HAM Chamber, Optical Table, Hole Tabulation](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67117)

All of these documents are provided as “related document” links in the Document Control Center (DCC) entry for the top level chamber assembly drawings, [D0900365](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d0900365&version=) and [D0900520](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d0900520&version=).

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| 1. LHAM2 with vacuum equipment, HEPI | 1. LHAM2 without vacuum equipment, HEPI |
| 1. LHAM3 with vacuum equipment, HEPI | 1. LHAM3 without vacuum equipment, HEPI |

Figure LHAM2 and LHAM3 Installation

This installation includes the following principal, sub-system major assemblies:

| **Subsys.** | **Assy Dwg** | **Sub-Assembly Name** | **Image** |
| --- | --- | --- | --- |
| SEI | [D0900124](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D0900124&version=) | LHAM2-ISI assembly  *N.B.: LHAM2 and LHAM3 use the same ISI assembly* |  |
| SEI | [D1001472](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1001472&version=) | LHAM2 Table Extension Assembly (LHAM2 only) |  |
| SUS | [D0900368](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1081) | HLTS suspension assembly (PR3) (LHAM2 only)  including:  HLTS Assembly ([D070447](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D070447&version=))  Vibration Absorbers ([D1002424](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1002424&version=))  Optics Cap ([D1101127](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101127&version=)) |  |
| SUS | [D0900413](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1159) | LHAM2, HSTS suspension assembly (MC1) (LHAM2 only)  including:  HSTS Assembly ([D020700](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=6873))  SUS Structure Spacer ([D1100049](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=31717))  Vibration Absorbers ([D1002424](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1002424&version=))  Optics Cap ([D1101143](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101143&version=)) |  |
| SUS | [D0900414](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1160) | LHAM2, HSTS suspension assembly (MC3) (LAM2 only)  including:  HSTS Assembly ([D020700](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=6873))  SUS Structure Spacer ([D1100049](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=31717))  Vibration Absorbers ([D1002424](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1002424&version=))  Optics Cap ([D1101143](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101143&version=)) |  |
| SUS | [D0900415](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1162) | LHAM2, HSTS suspension assembly (PRM) (LHAM2 only)  including:  HSTS Assembly ([D020700](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=6873))  SUS Structure Spacer ([D1100049](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=31717))  Vibration Absorbers ([D1002424](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1002424&version=))  Optics Cap ([D1101143](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101143&version=)) |  |
| SUS | [D0900524](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D0900524&version=) | LHAM2, HSTS suspension assembly (MC2) (LHAM3 only)  including:  HSTS Assembly ([D020700](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=6873))  SUS Structure Spacer ([D1100049](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=31717))  Vibration Absorbers ([D1002424](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1002424&version=))  Optics Cap ([D1101143](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101143&version=)) |  |
| SUS | [D0900526](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D0900526&version=) | LHAM2, HSTS suspension assembly (PR2) (LHAM3 only)  including:  HSTS Assembly ([D020700](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=6873))  SUS Structure Spacer ([D1100049](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=31717))  Vibration Absorbers ([D1002424](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1002424&version=))  Optics Cap ([D1101143](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101143&version=)) |  |
| IO | [D1101537](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1101537&version=) | LHAM2 AUX assembly (SM1) ([D1000120](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=8638)) (LHAM2 only)  including:  Baffle Plate ([D0902378](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=6213))  Riser Assembly ([D1101523](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1101523&version=)) |  |
| IO | [D1101538](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101538&version=) | LHAM2 AUX assembly (SM2) ([D1000120](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=8638)) (LHAM2 only)  including:  Baffle Plate ([D1002745](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=22353))  Riser Assembly ([D1101523](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1101523&version=)) |  |
| IO | [D1101539](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=68189) | LHAM2 AUX assembly (PMMT1) ([D1000120](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=8638)) (LHAM2 only)  including:  Protection Baffle Plate ([D0902380](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=6213))  Transmission Baffle Plate ([D1003045](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1003045&version=))  Riser Assembly ([D1101523](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1101523&version=)) |  |
| IO | [D1101540](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=68190) | LHAM2 AUX assembly (PMMT2) ([D1000120](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=8638)) (LHAM2 only)  including:  Baffle Plate ([D0902382](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=6213))  Riser Assembly ([D1101523](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1101523&version=)) |  |
| IO | [D1000332](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1000332&version=) | L1 Faraday Isolator Assembly (LHAM2 only) |  |
| IO | [D1101059](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1101059&version=) | IO ISS PD Assembly (LHAM 2 only) |  |
| IO | [D1002677](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1002677&version=) | IO Reflecting Periscope Assembly (LHAM2 only)  (2 required for LHAM2) |  |
| IO | [D1002350](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1002350&version=) | IO In Vacuum Periscope Assembly (LHAM2 only) |  |
| IO | [D1002585](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1002585&version=) | Refl Beam Dump Assembly (LHAM2 only) |  |
| IO | [D1101406](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1101406&version=) | LHAM2 Fixed Mount Optics Assembly (LHAM2 only)  Includes the following 16 sub assemblies:   1. [D1101466](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101466&version=) Adaptive Optical Element Dummy HA12 Assy. 2. [D1102059](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1102059&version=) Adaptive Optical Element Dummy HA12 Assy. 3. [D1002075](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1002075&version=) (4.235) Rigid Optic Mount RH Assy. (6 each) 4. [D1002085](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1002085&version=) (3.235) ) Rigid Optic Mount LH Assy. (2 each) 5. [D1002085](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1002085&version=) (4.235) ) Rigid Optic Mount LH Assy. 6. [D1002088](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1002088&version=) (4.235) Actuated Rigid Optic Mount RH Assy. 7. [D1100789](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1100789&version=) (3.235) aLIGO In-Vac QPD Assy. |  |
| IO | [D1002171](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1002171&version=) | Optic Mount Components (LHAM3 only)  Includes the following 6 sub assemblies:   1. [D1002075](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1002075&version=) Rigid Optic Mount RH Assy. 2. [D1002088](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1002088&version=) Actuated Optic Mount RH Assy. 3. [D1002085](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1002085&version=) Rigid Optic Mount LH Assy. 4. [D1101043](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1101043&version=) POP Beams 3" Optic Assy. 5. [D1101225](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1101225&version=) Black Glass Dump Assy (2 each) 6. [D1100789](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1100789&version=) (3.235) aLIGO In-Vac QPD Assy. | Image unavailable |
| IO | [D1101408](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1101408&version=) | IO Straight Baffle Assembly (LHAM 2 only) includes the following eight sub assemblies:   1. [D0902385](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d0902385&version=) Straight HA1 Baffle Assy 2. [D0902389](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d0902389&version=) Straight HA3 Baffle Assy 3. [D1003019](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1003019&version=) Straight P1 Baffle Assy 4. [D1101414](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101414&version=) MC3 AR Baffle Assy 5. [D1101416](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101416&version=) Straight HA13 Baffle Assy 6. [D1101417](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101417&version=) Straight HA11 Baffle Assy 7. [D1101419](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101419&version=) Straight HA9 Baffle Assy 8. [D1101422](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101422&version=) PRM AR Baffle Assy |  |
| IO | D11001412 | IO EQ Stop Baffle Assembly (LHAM2 only)  Includes three of the following sub assembly:  [D11001212](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1101212&version=) EQ Stop Baffle |  |
| IO | [D1000327](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1000327&version=) | IO MC2 Scraper Baffle Assembly (LHAM3 only) |  |
| IO | [D1000328](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1000328&version=) | IO PR2 Scraper Baffle Assembly (LHAM3 only) |  |
| AOS/ OptLev | [D1101392](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101392&version=) | DLC Assembly |  |
| SYS | [D1001625](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1001625&version=) | LHAM2 ISI Table Balance Masses |  |
| SYS | [D1101118](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D1101118&version=) | LHAM3 ISI Table Balance Masses |  |
| SEI/SYS | [D1101775](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=25833)  [D1000581](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=10116)  [D1101463](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=d1101463&version=) | Electrical Feedthrough Types  Cable Routing, HAM2  Cable Routing, HAM3 |  |
| AOS/SLC | [T1100292](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=61876) | Viewport Source List |  |
|  | | | |
|  |  |  |  |
| Cable tray | [D1100430](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=39655) | BSC Cable Tray Overall Assy  needs revision to as-built (as being built) design |  |

# Required Equipment List

Each of the procedures referenced within this overall procedure call out required equipment and parts/assemblies. Below is listed only those parts or assemblies not covered in the subsidiary procedures.

* LIGO-D1101674: [aLIGO, SUS, BSC/HAM INSTALLATION TOOLING](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=69647)
  + for transporting HXTS and OMC structures (sheets 4, 5 & 6)
  + Genie lift adapter plate, D110515,
* LIGO-D1101854: [aLIGO, HAM INSTALLATION ARM USAGE](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=71159)
  + LIGO-D1001994: [aLIGO, HAM INSTALLATION ARM, ASSEMBLY, FLANGE MOUNT](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=14036)
  + LIGO-D1002052: [aLIGO, ASSEMBLY, HAM ARM](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=14148)
  + LIGO-D1001664: [HAM STRUCTURE LIFT ASSEMBLY, aLIGO, SUS](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=13100)
  + LIGO-D1101674: [aLIGO, SUS, BSC/HAM INSTALLATION TOOLING](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=69647)
    - see sheet 11 of D1101674
* LIGO-E1100831: [HAM Installation Arm User Guide](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=70186)
* LIGO-D1001664: [HAM STRUCTURE LIFT ASSEMBLY, aLIGO, SUS](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=13100)
  + HAM vertical lift, D1001667 (sheet 11)- 1 lift at each site (lifting arms, extenders being returned to CIT for rework). 1 spare at CIT
* *completed, approved or checked by:   
  date:*

*comments (optional):*

# ISI Installation for LHAM2 and LHAM3

## Prepare the Chambers for ISI Installation

* The oxide layer removed from the interior of the lower shell of the BSC vacuum chamber, and the BSC chamber certified as “clean”.
* Install HEPI per [E040011](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=20879)
* Install the cable tray ([D1100430](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=39655)) around the LHAM2 and LHAM3 chamber. *(Note: The wire tray support brackets will be different than shown in the drawing, but similar in overall concept/layout; Drawing to be revised.)*
* Install HAM Chamber Cleanrooms around the LHAM2 and LHAM3 chambers and clean the chamber exterior and the region around the chambers.
* Vent the Y-Manifold vacuum volume and set the purge gas flowing per procedure [M1000360](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=25204). Follow the Lockout-Tagout procedure [M990190](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=10775)
* Install the dial indicators on the HAM support tube ends
* Remove the LHAM2 and LHAM3 Chamber Doors per procedure [M1000362](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=25206)
* Install the electrical feed-throughs listed in [D1002873](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=22869), per procedure [M990173](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=66398)  
  *Note: The electrical feed-throughs can be installed later in the sequence.*
* Install the field cabling from the electrical feed-throughs to the electronics racks, per D#s?  
  *Note: The field cabling can be installed later, but must be done after the cable trays are in place, yet before the ISI is installed.*
* Install the viewports listed in [T1100292](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=61876) for LHAM2 and LHAM3, per procedures [E1100484](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=62075) and [M990173](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=66398)  
  *Note: The viewports can be installed later in the sequence.*
* Insure that the support tubes are level (to within 0.4 mrad) with a precision bubble level and HEPI static adjustment (per procedure [E040011](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=20879))
* *completed, approved or checked by:   
  date:*

*Version numbers of all subsidiary documents followed:*

*comments (optional, e.g. deviations, exceptions, problems, “punch-list”):*

## Install the LHAM2 and LHAM3 ISI Assemblies

* Install the ISI assemblies into their vacuum chambers per [E080012](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=22581).
* *completed, approved or checked by:   
  date:*

*comments (optional):*

## Perform final HAM-ISI testing/characterization prior to payload integration

* *completed, approved or checked by:   
  date:*

*comments (optional):*

# PROCEDURE FOR LHAM2 and LHAM3 CHAMBER ASSEMBLY

The LHAM2 assembly is depicted in . The major optics assemblies integrated into the LHAM2 assembly are the Power Recycling Mirror 3 (PR3) suspension assembly ([D0900368](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1081)), the Power Recycling Mirror (PRM) suspension assembly ([D0900415](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1162)), the Mode Cleaner 1 Mirror (MC1) suspension assembly ([D0900413](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1159)) and the Mode Cleaner Mirror 3 (MC3) suspension assembly ([D0900414](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1160)).

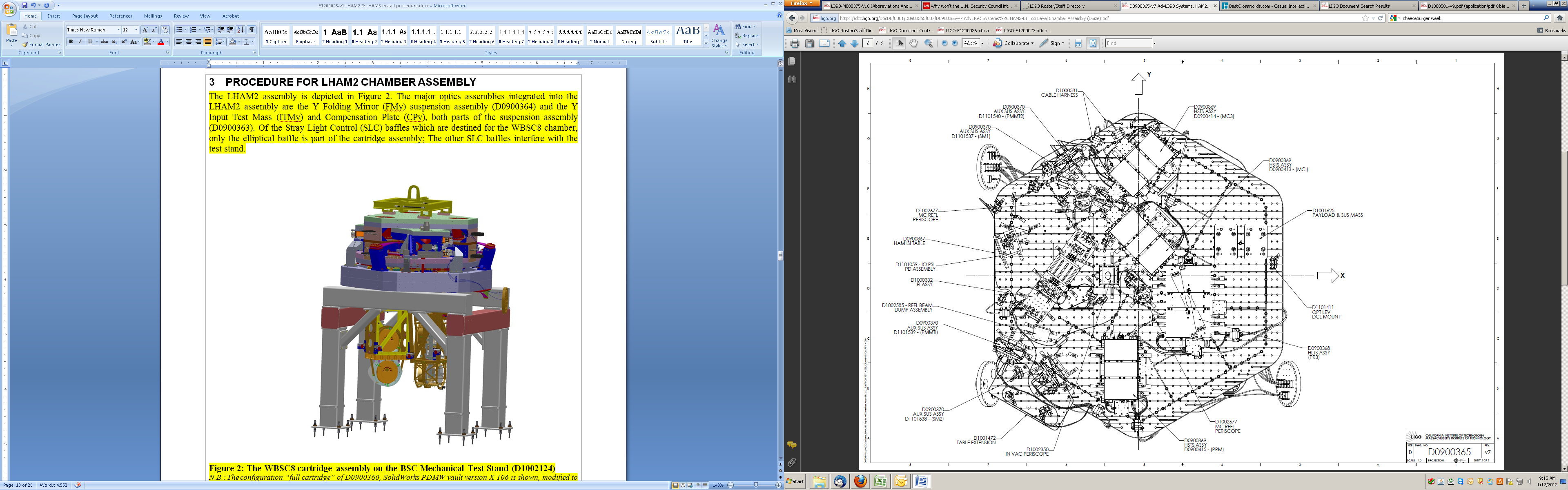


Figure 2: The LHAM2 ASSEMBLY ([D0900365](https://dcc.ligo.org/DocDB/0001/D0900365/007/D0900365-v7%20AdvLIGO%20Systems%2C%20HAM2-L1%20Top%20Level%20Chamber%20Assembly%20%28DSize%29.pdf))

The LHAM3 assembly is depicted in Figure 3. The major optics assemblies integrated into the LHAM3 assembly are the Power Recycling Mirror 2 (PR2) suspension assembly ([D0900526](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D0900526&version=)), and the Mode Cleaner Mirror 2 (MC2) suspension assembly ([D0900524](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D0900524&version=)).

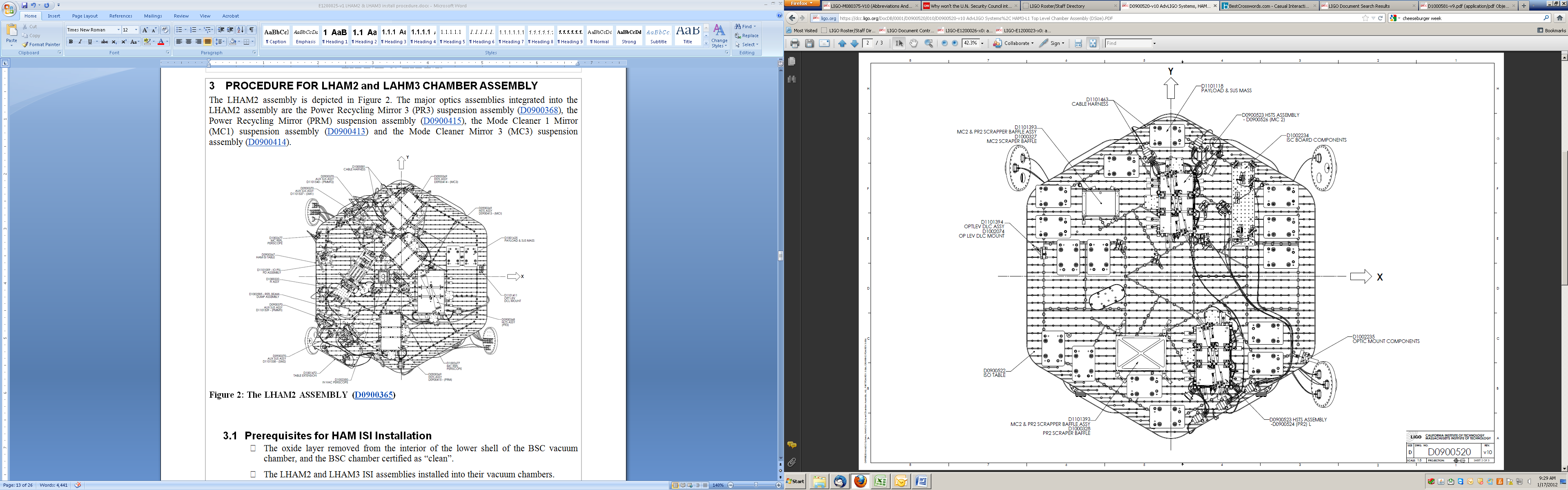


Figure LHAM3 ISI Assembly ([D0900520](https://dcc.ligo.org/DocDB/0001/D0900520/010/D0900520-v10%20AdvLIGO%20Systems%2C%20HAM3-L1%20Top%20Level%20Chamber%20Assembly%20%28DSize%29.PDF))

## Applicable Documents

Listed below are all of the applicable and referenced documents for this installation procedure. This list gives the latest revisions of the documents; within the installation steps, only the document number (and not the revision) is quoted.

Only documents actually required to perform the installation should be included in this list and not background or reference material. It is essential that all of the procedures and all of the drawings listed below are available with this procedure during the installation/integration work.

|  |  |
| --- | --- |
| **Document No.** | **Document Title** |
| **General Documents** | |
| [E0900047-v12](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=e0900047&version=) | LIGO Contamination Control Plan |
|  |  |
|  |  |
| **Install/Align Procedures** | |
| [T1000097](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=t1000097&version=) | Input Optics Plan |
| [E1100783](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=69622) | Initial Alignment Procedure: LHAM2 and LHAM3 |
|  |  |
|  |  |
| **Test Procedures** | |
|  |  |
|  |  |
|  |  |
| **Safety** | |
|  |  |
|  |  |
|  |  |
| **Drawings** | |
| LHAM2 |  |
| LIGO-D0900365: [AdvLIGO Systems, HAM2-L1 Top Level Chamber Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1070) | |
| LIGO-D0900367: [AdvLIGO SEI HAM2-L1, XYZ Local CS for ISO Table](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1080) | |
| LIGO-D0900368: [AdvLIGO SUS HAM2-L1, XYZ Local CS for HLTS (PR3)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1081) | |
| LIGO-D0900369: [AdvLIGO SUS HAM2-L1, XYZ Local CS for HSTS (MC1,MC3,PRM)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1082) | |
| LIGO-D0900370: [AdvLIGO IO HAM2-L1, XYZ Local CS for SOS Assy (SM1,SM2,PMMT1,PMMT2)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1083) | |
| LIGO-D1101537: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS (SM1) Sub-Assy](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=68187) | |
| LIGO-D1101538: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS (SM2) Sub-Assy](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=68188) | |
| LIGO-D1101539: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS (PMMT1) Sub-Assy](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=68189) | |
| LIGO-D1101540: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS (PMMT2) Sub-Assy](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=68190) | |
| LIGO-D0900371: [AdvLIGO IO HAM2-L1 XYZ Local CS for Faraday Isolator](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1084) | |
| LIGO-D0900420: [AdvLIGO IO HAM2-L1, XYZ Local CS for In Vacuum Periscope](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1187) | |
| LIGO-D1101406: [AdvLIGO SUS HAM2-L1, XYZ Local CS for Fixed Mount Optics](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67378) | |
| LIGO-D1000581: [CABLE HARNESS ROUTING CONFIGURATION - HAM2](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=10116) | |
| LIGO-D1001625: [AdvLIGO HAM2-L1 ISI Table, Payload & Suspended Mass Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=12893) | |
| LIGO-D1101408: [AdvLIGO, SUS HAM2-L1 Table, IO Straight Baffle Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67380) | |
| LIGO-D1101409: [AdvLIGO IO HAM2-L1, XYZ Local CS for Refl Beam Dump Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67381) | |
| LIGO-D1101410: [AdvLIGO IO HAM2-L1, XYZ Local CS for IO PSL PD Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67382) | |
| LIGO-D1101411: [AdvLIGO SEI HAM2-L1, XYZ Local for OptLev DLC Components](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67384) | |
| LIGO-D1101412: [AdvLIGO IO HAM2-L1 Table, IO EQ Stop Baffle Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67385) | |
| LIGO-D1101296: [ALIGO, AOS, HAM Chamber, Optical Table, Hole Tabulation](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67117) | |
| LIGO-D1002885: [Flange Layout - L1 Horizontal Access Module 2 (HAM 2)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=22883) | |
| LIGO-D1101233: [ALIGO IO L1 HAM2 INSTALLATION PLATE LAYOUT](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=66708) | |
|  | |
| LHAM3 |  |
| LIGO-D0900520: [AdvLIGO Systems, HAM3-L1 Top Level Chamber Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1491) | |
| LIGO-D0900523: [AdvLIGO SUS HAM3-L1, XYZ Local CS for HSTS (PR2, MC2)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1494) | |
| LIGO-D0900522: [AdvLIGO SEI HAM3-L1, XYZ Local CS for ISO Table](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1493) | |
| LIGO-D0900524: [AdvLIGO SUS HAM3-L1, XYZ Local CS for HSTS (PR2) Sub-Assy](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1495) | |
| LIGO-D0900526: [AdvLIGO SUS HAM3-L1, XYZ Local CS for HSTS (MC2) Sub-Assy](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=1497) | |
| LIGO-D1101393: [AdvLIGO SUS HAM3-L1, XYZ Local CS for MC2 and PR2 Scraper Baffles](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67335) | |
| LIGO-D1101118: [AdvLIGO HAM3-L1 ISI Table, Balance Masses Assembly](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=62705) | |
| LIGO-D1002235: [AdvLIGO SEI HAM3-L1, XYZ Local CS for IO Optic Mount Components](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=14681) | |
| LIGO-D1002234: [AdvLIGO SEI HAM3-L1, XYZ Local CS for ISC Components](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=14680) | |
| LIGO-D1101463: [CABLE HARNESS ROUTING CONFIGURATION, HAM 3](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67608) | |
| LIGO-D1002886: [Flange Layout - L1 Horizontal Access Module 3 (HAM 3)](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=22885) | |
| LIGO-D1101249: [ALIGO IO L1 HAM3 INSTALLATION PLATE LAYOUT](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=66790) | |
|  | |
| Common |  |
| LIGO-D1101775: [ALIGO, ELECTRICAL FEEDTHROUGH TYPES, TYPICAL SUBFLANGES, AND PORT CONFIGURATIONS](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=70179) | |
| LIGO-F1100030: [aLIGO Systems HAM2/3 Related Documents](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67119) | |
| LIGO-G1000125: [Advanced LIGO BSC and HAM ISI Conventions](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=9377) | |
| LIGO-D1101296: [ALIGO, AOS, HAM Chamber, Optical Table, Hole Tabulation](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67117) | |

## Weigh the full suspension payloads

* Weigh the full MC3 HSTS suspension, record below
* Weigh the full MC1 HSTS suspension, record below
* Weigh the full PR3 HLTS suspension, record below
* Weigh the full PRM HSTS suspension, record below
* Weigh the full MC2 HSTS suspension, record below
* Weigh the full PR2 HSTS suspension, record below
* Systems to confirm, or revise, the mass balancing plan/drawing (REF?)

|  |  |  |
| --- | --- | --- |
| Payload | Mass (Kg) | Comments/caveats |
| MC3 HSTS Suspension |  |  |
| MC1 HSTS Suspension |  |  |
| PR3 HLTS Suspension |  |  |
| PRM LSTS Suspension |  |  |
| MC2 HSTS Suspension |  |  |
| PR2 HSTS Suspension |  |  |

* *completed, approved or checked by:   
  date:*

*comments (optional):*

## Install LHAM2 table extension assembly

## Install the balance masses onto the optics tables

* Install the balance masses in accordance with [D1001625](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=12893): AdvLIGO HAM2-L1 ISI Table, Payload & Suspended Mass Assembly, and [D1101118](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=62705): AdvLIGO HAM3-L1 ISI Table, Balance Masses Assembly.

## Install the Optical Lever mirror assemblies

## Install the IO components

* See [T1000097](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=9466), *Input Optics Installation Plan* for installation of IO components.
* *completed, approved or checked by:   
  date:*

*comments (optional):*

## Add Vibration Absorbers to the PRM, PR3, MC1, MC3, PR2, and MC2 Suspensions

* Install per ([D020700](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=6873)) and ([D070447](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?.submit=Number&docid=D070447&version=)).

## Rebalance the ISI Tables

## Align the Optics

* Align the optical elements on the cartridge in accordance with [E1100783](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=69622): Initial Alignment Procedure - LHAM2 and LHAM3.
* *completed, approved or checked by:   
  date:*

*comments (optional):*

## Clean the Optics

* Inspect the optical surfaces. If cleaning is required, then complete the following steps:
* Lock down the HAM-ISI stages per [E1101037](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=73780)
* Lock down ITMy per [T1100406](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=67995)
* Lock down the FMy per [T1100489](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=70641)
* Clean the optics if needed. First Contact™ cleaning (per procedure [E1000079](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=9858)) is the preferred method.
* *completed, approved or checked by:   
  date:*

*Version numbers of all subsidiary documents followed:*

*comments (optional, e.g. deviations, problems):*

# Testing

Conduct final checkout and inspection per [T1000097](https://dcc.ligo.org/cgi-bin/private/DocDB/ShowDocument?docid=9466).

* *completed, approved or checked by:   
  date:*

*Version numbers of all subsidiary documents followed:*

*comments (optional, e.g. deviations, problems):*